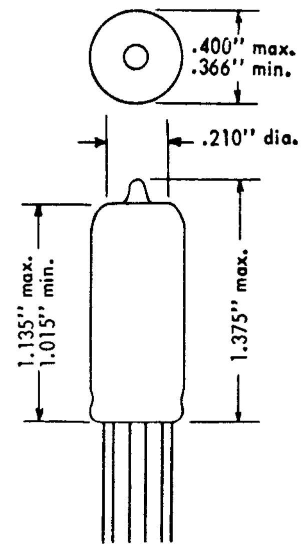
TECHNICAL INFORMATION

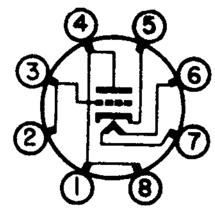
RAYTHEON

Excellence in Electronics

RELIABLE SUBMINIATURE TRIODE

TYPE CK6533WA





BOTTOM VIEW

8FY

The CK6533WA is a heater-cathode type high-mu triode of subminiature construction designed for applications where freedom from microphonic response is of primary importance. The mechanical design is such that microphonic output due to structural resonances is reduced throughout the audio frequency range by approximately 20 db as compared to more conventional triodes. The maximum equivalent grid noise voltage with applied vibrational acceleration of 15 G at 40 cps is 85 μVac. It is particularly useful in voltage amplifier circuits where its low microphonic noise and vibration output are essential for specialized military electronic equipment. It is intended for service where extreme conditions of mechanical shock or vibration are encountered. The CK6533WA is similar to the type CK6247WA but is improved for microphonics. The flexible terminal leads may be soldered or welded directly to the terminals of circuit components without the use of sockets. Standard 8-Pin subminiature sockets may be used by cutting the leads to a suitable length.

MECHANICAL DATA

ENVELOPE: T-3 Glass

BASE: Subminiature Button 8-Pin (0.017" tinned flexible leads. Length: 1.5" min.)

TERMINAL CONNECTIONS:

Lead 1 Plate	Lead 5 Cathode
Lead 2 Grid	Lead 6 Heater
Lead 3 Grid	Lead 7 Heater
Lead 4 Plate	Lead 8 Plate

MECHANICAL RATINGS:

Maximum Impact Acceleration (Shock Test-Note 3)	450 G
Maximum Uniform Acceleration (Centrifuge Test-Note 4)	1000 G
Maximum Vibrational Acceleration (96 Hour Fatigue Test-Note 5)	2.5 G
Maximum Bulb Temperature	220 °C

MOUNTING POSITION: Any

ELECTRICAL DATA

CAUTION-----To Electronic Equipment Design Engineers: Special attention should be given to the temperature at which the tubes are to be operated. Reliability will be seriously impaired if maximum bulb temperature is exceeded. The life expectancy may be reduced if conditions other than those specified for life test are imposed on the tube and will be reduced appreciably if maximum ratings are exceeded. Both reliability and performance will be jeopardized if filament voltage ratings are exceeded. Life and reliability of performance are closely related to the degree that regulation of the heater voltage is maintained at its center rated value.

RATINGS AND NORMAL OPERATION	MIL-E-1 SYMBOL	DESIGN MINIMUM	NORMAL TEST CONDITIONS (Note 7)	NORMAL OPERATION (Note 6)	DESIGN MAXIMUM	MIL-E-1 UNITS
Heater Voltage (Note 8)	Ef:	5.7	6.3	6.3	6.9	V
Plate Voltage	Eb:	----	120	120	150	Vdc
Grid #1 Voltage	Ec1	-55	0	0	0	Vdc
Plate Dissipation	Pp:	----	----	0.11	0.5	W
Heater-Cathode Voltage	Ehk:	-200	----	100	+200	v
Plate Current	Ib:	----	----	0.9	2.5	mAdc
Cathode Resistance	Rk:	----	1500	1500	----	ohms
Grid Circuit Resistance	Rg:	----	----	----	1.2	Meg.
Transconductance (1):	Sm(1):	----	----	1750	----	μmhos
Amplification Factor	Mu:	----	----	54	----	----

Tentative Data

ELECTRICAL DATA (Cont'd)

CHARACTERISTICS AND QUALITY CONTROL TESTS (Note 1)

TEST	CONDITIONS	AQL %	MIL-E-1 SYMBOL	MIN	LAL	BOGIE	UAL	MAX	ALD	MIL-E-1 UNITS
MEASUREMENTS ACCEPTANCE TESTS PART 1			Combined AQL=1.0% excluding Mechanical and Inoperatives							
Heater Current		0.65	If:	190	----	200	----	210	----	mA
Heater-Cathode Leakage:	Ehk=+100 Vdc	0.65	Ihk:	----	----	----	----	5	----	μAdc
	Ehk=−100 Vdc		Ihk:	----	----	----	----	5	----	μAdc
Grid Current		0.65	Ic(1):	----	----	----	----	−0.1	----	μAdc
Plate Current (1):		0.65	Ib(1):	0.6	----	0.9	----	1.25	----	mAdc
Plate Current (2):	Ec1=−3.5 Vdc	0.65	Ib(2):	----	----	----	----	50	----	μAdc
Transconductance (1):		0.65	Sm(1):	1400	1575	1750	1925	2100	360	μmhos
Continuity and Shorts (Inoperatives):		0.4	----	----	----	----	----	----	----	----
Mechanical:	Envelope (8−1) (Note 10)	----	----	----	----	----	----	----	----	----
MEASUREMENTS ACCEPTANCE TESTS PART 2										
Insulation of Electrodes:	Ef=6.3 V; Eg−all=−100 Vdc	2.5	Rg1-all:	100	----	----	----	----	----	Meg.
	Ep−all=−300 Vdc		Rp-all:	100	----	----	----	----	----	Meg.
Plate Current (3):	Ec1=−2.0 Vdc	2.5	Ib(3):	5	----	----	----	----	----	μAdc
Transconductance (2):	Ef=5.7 V (Note 9)	2.5	Δ_{Ef}Sm(2):	----	----	----	----	7.5	----	%
Grid Emission:	Ef=7.5 V; Rg=1.0 Meg. Preheat 5 minutes at Ec1=0; Test at Ec1=−3.5 Vdc.	6.5	Ic(2):	----	----	----	----	−0.3	----	μAdc
AF Noise:	Esig=35 mVac; Rg=1.0 Meg.; Rp=0.2 Meg.	2.5	EB:	----	----	----	----	17	----	VU
Amplification Factor:		6.5	Mu:	48	----	54	----	60	----	----
Capacitance:			Cgp:	1.2	----	1.6	----	2.0	----	μμf
Capacitance:	Note 2	6.5	Cin:	1.3	----	1.75	----	2.2	----	μμf
Capacitance:			Cout:	0.4	----	0.6	----	0.8	----	μμf
Low Pressure Voltage Breakdown:	Pressure=55±5 mm Hg; Voltage=300 Vac	6.5	----	----	----	----	----	----	----	----
Operation Time:	(Note 11)	4.0	t:	----	----	----	----	20	----	sec.
Vibration (2):	Rp=10,000 ohms; F=40 cps; G=15	2.5	Ep:	----	----	----	----	1.0	----	mVac
Vibration (3):	Rp=10,000 ohms; F=30−1000 cps; G=15; position X_1 and X_2 only.	4.0	ep:	----	----	----	----	15 peak to peak	----	mv
DEGRADATION RATE ACCEPTANCE TESTS										
Subminiature Lead Fatigue:		2.5	----	4.0	----	----	----	----	----	arcs
Shock (1):	Hammer Angle=30°; Ehk=+100 Vdc; Rg=0.1 Meg. (Note 3)	20	----	----	----	----	----	----	----	----
Fatigue (1):	96 Hours; G=2.5; Fixed frequency; F=25 min., 60 max. (Note 5)	6.5	----	----	----	----	----	----	----	----
Fatigue (2):	6 Hours; G=10; Fixed frequency; F=25 min., 60 max. (Note 12)	6.5	----	----	----	----	----	----	----	----
Post Shock (1) and Fatigue Tests (1) and (2) End Points:										
Vibration (2):	F=40 cps; G=15; Rp=10,000 ohms	----	Ep:	----	----	----	----	3.0	----	mVac

ELECTRICAL DATA (Cont'd)

CHARACTERISTICS AND QUALITY CONTROL TESTS (Note 1) (cont'd)

TEST	CONDITIONS	AQL %	MIL-E-1 SYMBOL	MIN	MAX	MIL-E-1 UNITS	Allowable Defects per Characteristic 1st Sample	Combined Samples
DEGRADATION RATE ACCEPTANCE TESTS (cont'd)								
Heater-Cathode Leakage:	Ehk=+100 Vdc	----	Ihk:	----	10	μAdc		
	Ehk=−100 Vdc	----	Ihk:	----	10	μAdc		
Change in Transconductance (1) of individual tubes:	Ef=6.3 V	----	Δ_tSm(1):	----	10	%		
Grid Current:		----	Ic:	----	−1.0	μAdc		
Shock (2):	G=75; (Hammer Angle=120°+rubber pad); t=10 milliseconds; Ehk=+100 Vdc; Rg=0.1 Meg. (Note 13)	20	----	----	----	----		
Post Shock (2) Test End Points:								
Vibration (2):	F=40 cps; G=15; Rp=10,000 ohms	----	Ep:	----	3.0	mVac		
Heater-Cathode Leakage:	Ehk=+100 Vdc	----	Ihk:	----	10	μAdc		
	Ehk=−100 Vdc	----	Ihk:	----	10	μAdc		
Change in Transconductance (1) of individual tubes:	Ef=6.3 V	----	Δ_tSm(1):	----	10	%		
Grid Current:		----	Ic:	----	−1.0	μAdc		
Glass Strain (Thermal Shock):		6.5	----	----	----	----		
ACCEPTANCE LIFE TESTS								
Heater Cycling:	Ef=7.5 V; Eb=Ec1=0V; Ehk=140 Vac; 1 min. on, 1 min. off	1.0	----	2000	----	cycles		
Heater Cycling Life Test End Points:								
Heater-Cathode Leakage:	Ehk=+100 Vdc	----	Ihk:	----	20	μAdc		
	Ehk=−100 Vdc	----	Ihk:	----	20	μAdc		
1 Hour Stability Life Test:	TA=room; Ehk=+200 Vdc; Rg1=1.0 Meg.; Eb=150 Vdc; Rk=680 ohms	----	----	----	----	----		
1 Hour Stability Life Test End Points:	(Typical sample size=50 tubes)	1.0	----	----	----	----		
Change in transconductance (1) of individual tubes:		----	Δ_tSm(1):	----	10	%		
100 Hour Survival Rate Life Test:	TA=room; Ehk=+200 Vdc; Rg1=1.0 Meg.; Eb=150 Vdc; Rk=680 ohms	----	----	----	----	----		
100 Hour Survival Rate Life Test End Points:	(Typical sample size=200 tubes)							
Inoperatives:		0.65	----	----	----	----		
Transconductance (1):		1.0	Sm(1):	1200	----	μmhos		
Intermittent High Temperature Life Test:	T Bulb=220°C; Ehk=+200 Vdc; Rg1=1.0 Meg.; Eb=150 Vdc; Rk=680 ohms	----	----	----	----	----		
500 Hour Intermittent High Temperature Life Test End Points:	(Typical Sample Size=20 tubes 1st sample, 40 tubes 2nd sample)	----	----	----	----	----		
Inoperatives:		----	----	----	----	----	1	3
Grid Current (1):		----	Ic(1):	----	−0.5	μAdc	1	3
Heater Current:		----	If:	180	220	mA	1	3

ELECTRICAL DATA (Cont'd.)

CHARACTERISTICS AND QUALITY CONTROL TESTS (Note 1) (cont'd)

TEST	CONDITIONS	AQL %	MIL-E-1 SYMBOL	MIN	MAX	MIL-E-1 UNITS	Allowable Defects per Characteristic 1st Sample	Combined Samples
ACCEPTANCE LIFE TESTS (cont'd)								
Change in transconductance (1) of individual tubes:			Δ_tSm(1):		20	%	1	3
Transconductance (2):	(Note 9)		Δ_{Ef}Sm(2):		15	%	2	5
Heater-Cathode Leakage:	Ehk=+100 Vdc Ehk=−100 Vdc		Ihk: Ihk:		10 10	µAdc µAdc	2	5
Insulation of Electrodes:								
g1−all			Rg1−all:	50		Meg.	2	5
p−all			Rp−all:	50		Meg.		
Transconductance (1) Average Change:			AvgΔ_tSm(1):		15	%	...	...
Total Defectives:							4	8
1000 Hour Intermittent High Temperature Life Test End Points:	(Typical Sample Size= 20 tubes 1st sample, 40 tubes 2nd sample)						...	...
Inoperatives:							2	5
Grid Current (1):			Ic(1):		−1.0	µAdc	2	5
Heater Current:			If:	177	223	mA	2	5
Change in transconductance (1) of individual tubes:			Δ_tSm(1):		30	%	2	5
Heater-Cathode Leakage:	Ehk=+100 Vdc Ehk=−100 Vdc		Ihk: Ihk:		15 15	µAdc µAdc	2	5
Total Defectives:							5	10

NOTES

Note 1: Characteristics, Quality Control Test Procedures and Inspection Levels are made according to the appropriate paragraphs of MIL-E-1 "Inspection Instructions for Electron Tubes" and MIL-STD-105A.

Note 2: Without shield.

Note 3: Test conditions and acceptance criteria per Shock Test procedures of MIL-E-1 basic specifications.

Note 4: Centrifuge Test with forces applied in any direction.

Note 5: Test conditions and acceptance criteria per Fatigue Test Procedures of MIL-E-1 basic specifications.

Note 6: These normal values represent conditions at which control of reliability may be expected.

Note 7: These normal test conditions are used for all characteristic tests unless otherwise stated under the individual test item.

Note 8: For most applications the performance will not be adversely affected by ±10% heater voltage variation, but when the application can provide a closer control of heater voltage, an improvement in reliability will be realized.

Note 9: Change of transconductance for individual tubes from that value measured at Ef=6.3V to that value measured at Ef=5.7V.

Note 10: In addition to meeting the tightened electrical, physical and mechanical tests described in this data sheet these Raytheon Reliable Tubes are now guaranteed to be free from "potential" defects identifiable by microscopic inspection as described by paragraph 5.3.8 of "Inspection Instructions for Electron Tubes."

Note 11: Operation time is the time in seconds required for the plate current to attain a value within plus or minus 10 percent of the 3 minute plate current (1) value. No preheating before this test will be allowed.

ELECTRICAL DATA (Cont'd.)

NOTES (cont'd)

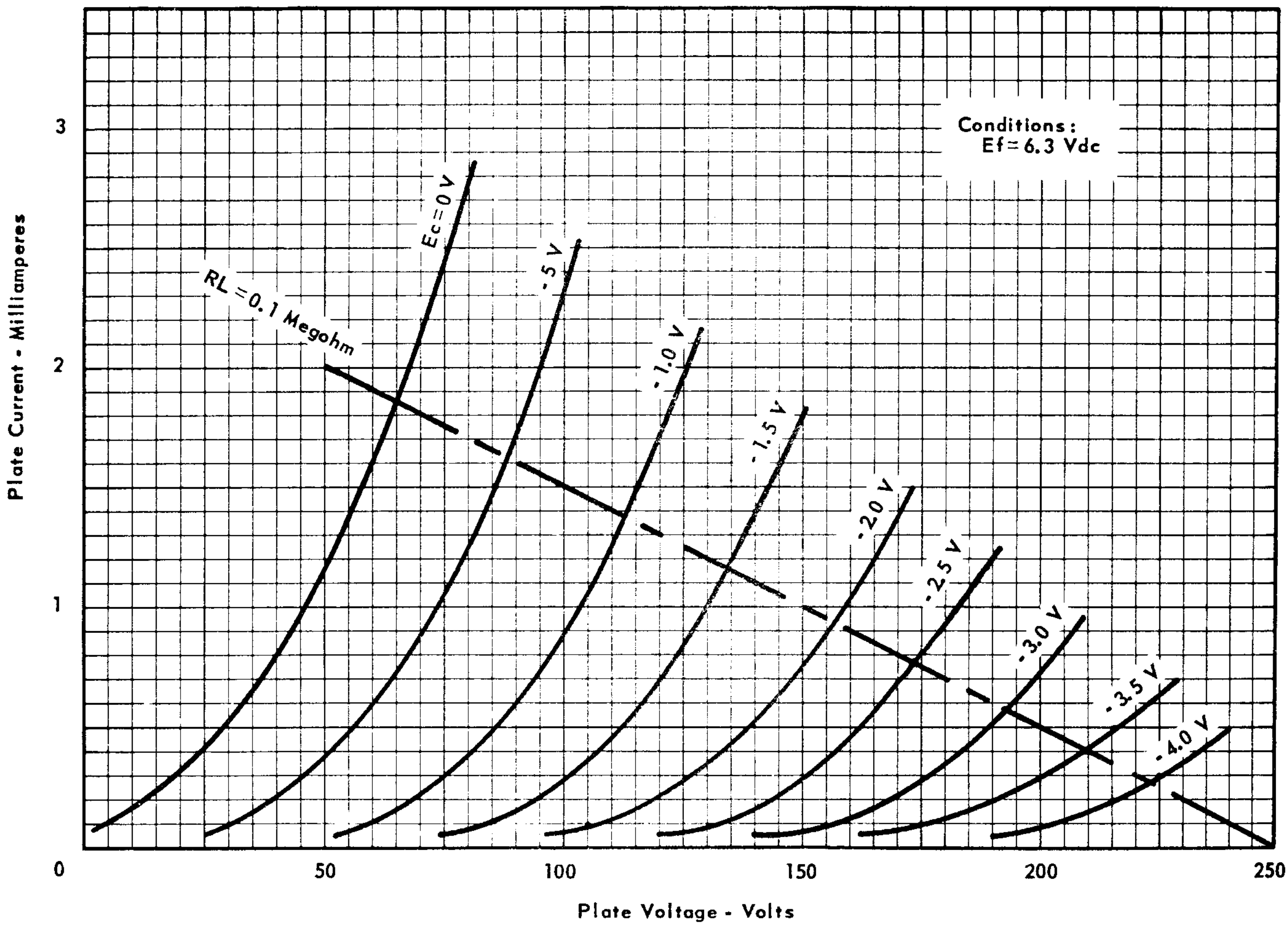
Note 12: The tubes shall be rigidly mounted on a table vibrating with simple harmonic motion. The tubes shall be vibrated for a total of 6 hours, 2 hours in each of three positions, X1, X2, and Y1. Only rated heater voltage shall be applied. Tubes which show one or more of the following defects shall be considered failures:

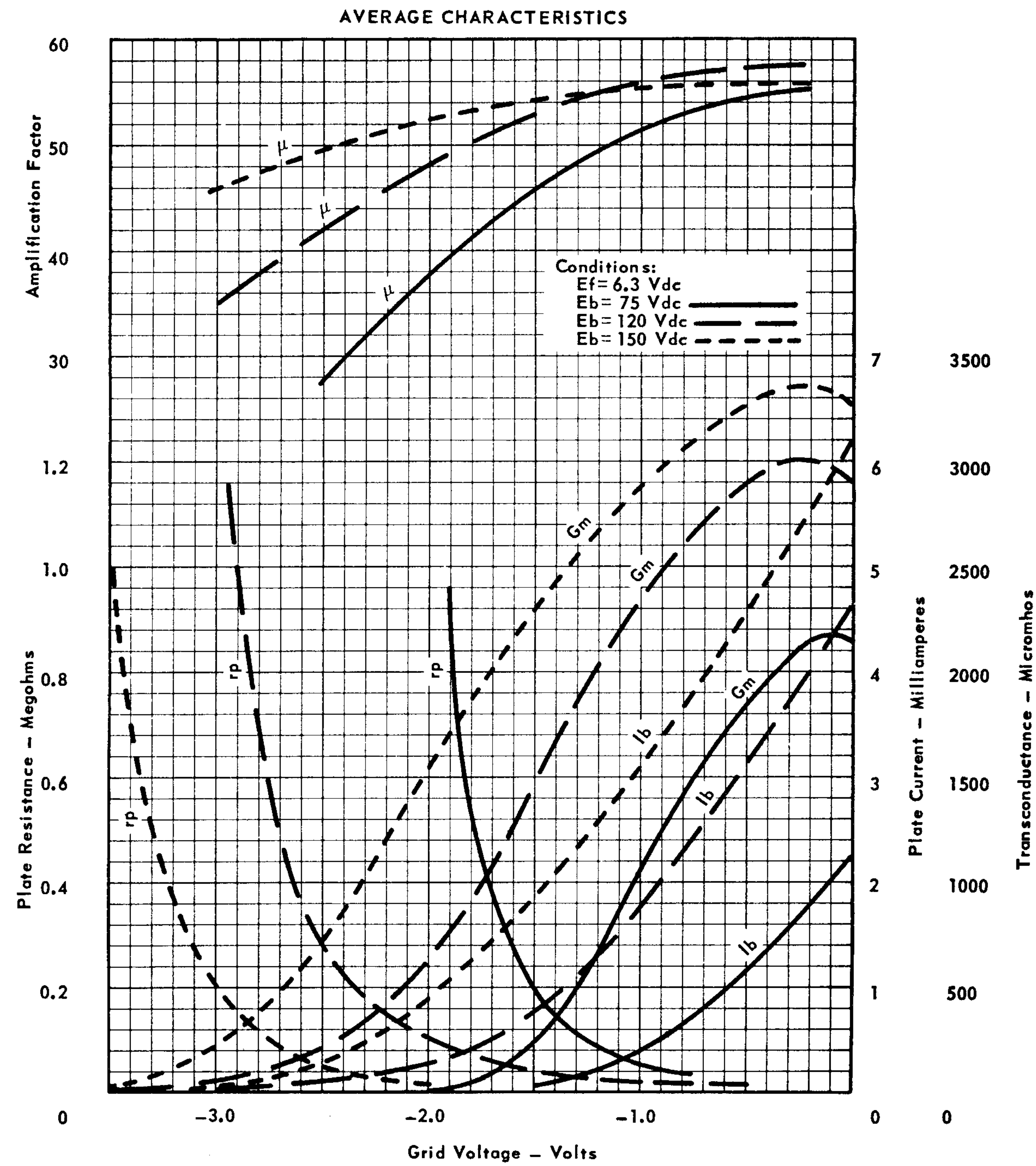
(a) Tubes which show permanent or tap shorts or open circuits following fatigue test, when tested as specified in 4.7.2 and 4.7.3 of Specification MIL-E-1.

(b) Tubes which do not comply with post fatigue limits. (This is a destructive test).

Note 13: The provisions of 4.9.20.5 of Specification MIL-E-1 shall apply, except for the test conditions specified herein for Shock Test (2).

AVERAGE PLATE CHARACTERISTICS




AVERAGE CHARACTERISTICS
Amplification Factor
60
50
40
30
μ
μ
μ
Conditions:
Ef=6.3 Vdc
Eb= 75 Vdc
Eb=120 Vdc
Eb=150 Vdc
Plate Resistance – Megohms
1.2
1.0
0.8
0.6
0.4
0.2
0
rp
rp
rp
Gm
Gm
Gm
Ib
Ib
Ib
Plate Current – Milliamperes
7
6
5
4
3
2
1
0
Transconductance – Micromhos
3500
3000
2500
2000
1500
1000
500
0
–3.0
–2.0
–1.0
Grid Voltage – Volts

TYPICAL VIBRATION OUTPUT VOLTAGE

